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Fig.1

Title: METHOD AND APPARATUS FOR PROVIDING AND
INTEGRATING HIGH-PERFORMANCE MESSAGE
QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
Docket No.: MSFT116666

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Fig.2

Title: METHOD AND APPARATUS FOR PROVIDING AND
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Inventor: Jeffrey E. Stall
Docket No.:   MSFT116666

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OPERATING SYSTEM
CORE

USER
COMPONENT

WINDOW MANAGER

GRAPHICAL DEVICE INTERFACE (GDI)

KERNEL

Fig.3

Title: METHOD AND APPARATUS FOR PROVIDING AND
          INTEGRATING HIGH-PERFORMANCE MESSAGE
          QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
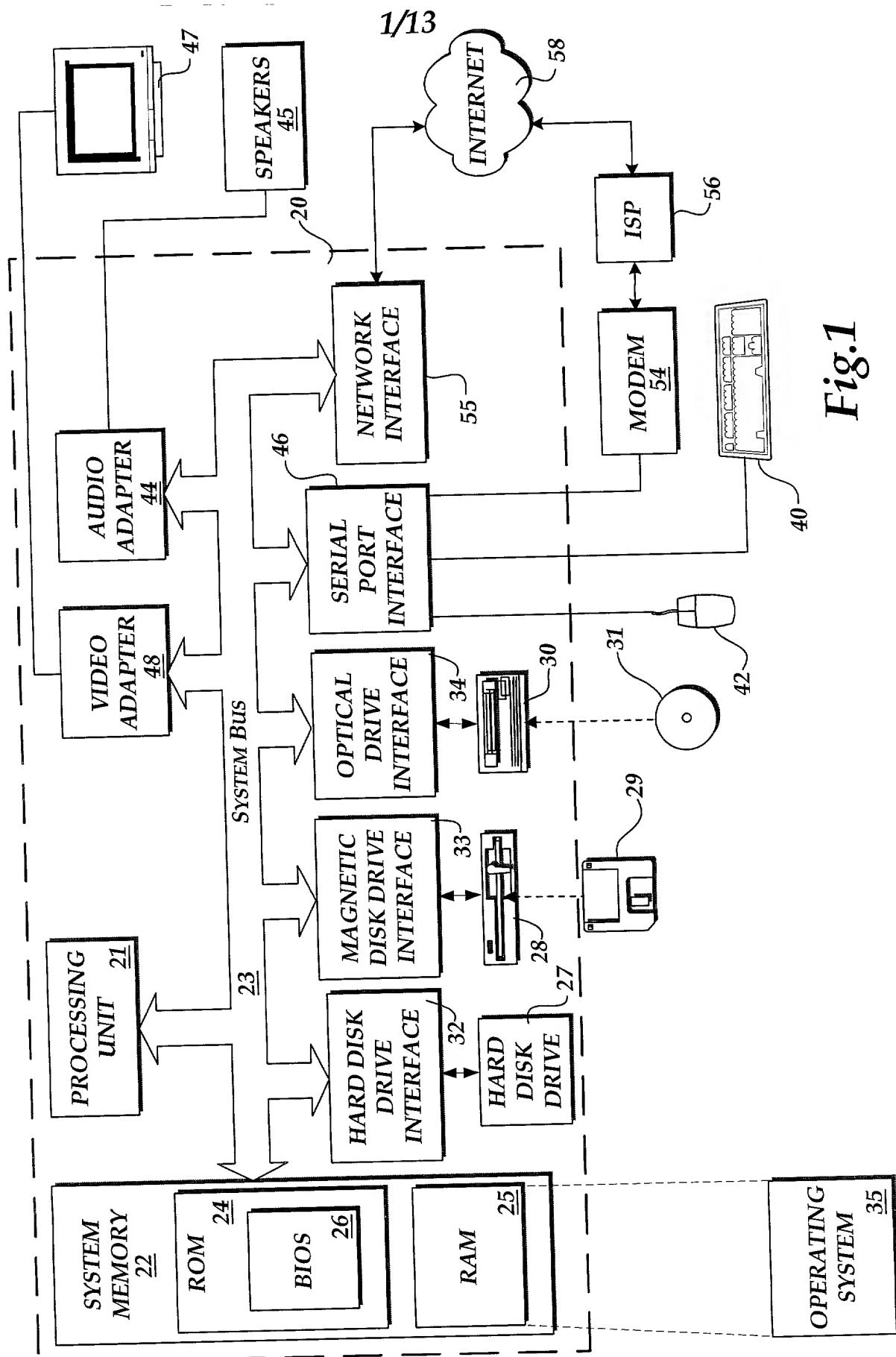Docket No.:   MSFT116666

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Fig.4

Title: METHOD AND APPARATUS FOR PROVIDING AND
         INTEGRATING HIGH-PERFORMANCE MESSAGE
         QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
Docket No.:   MSFT116666

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APPLICATION MESSAGE PUMP — 85

QUEUE BRIDGE — 94

LEGACY WINDOW MANAGER

LEGACY, SYSTEM LEVEL, LOCKING QUEUES — 92, 76

NEW WINDOW MANAGER

IDLE-TIME PROCESSING — 83

NON-LOCKING QUEUES — 82, 88A-N

Fig.5

Title: METHOD AND APPARATUS FOR PROVIDING AND
         INTEGRATING HIGH-PERFORMANCE MESSAGE
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Inventor: Jeffrey E. Stall
Docket No.:   MSFT116666

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Fig.6

Title: METHOD AND APPARATUS FOR PROVIDING AND
INTEGRATING HIGH-PERFORMANCE MESSAGE
QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
Docket No.: MSFT116666
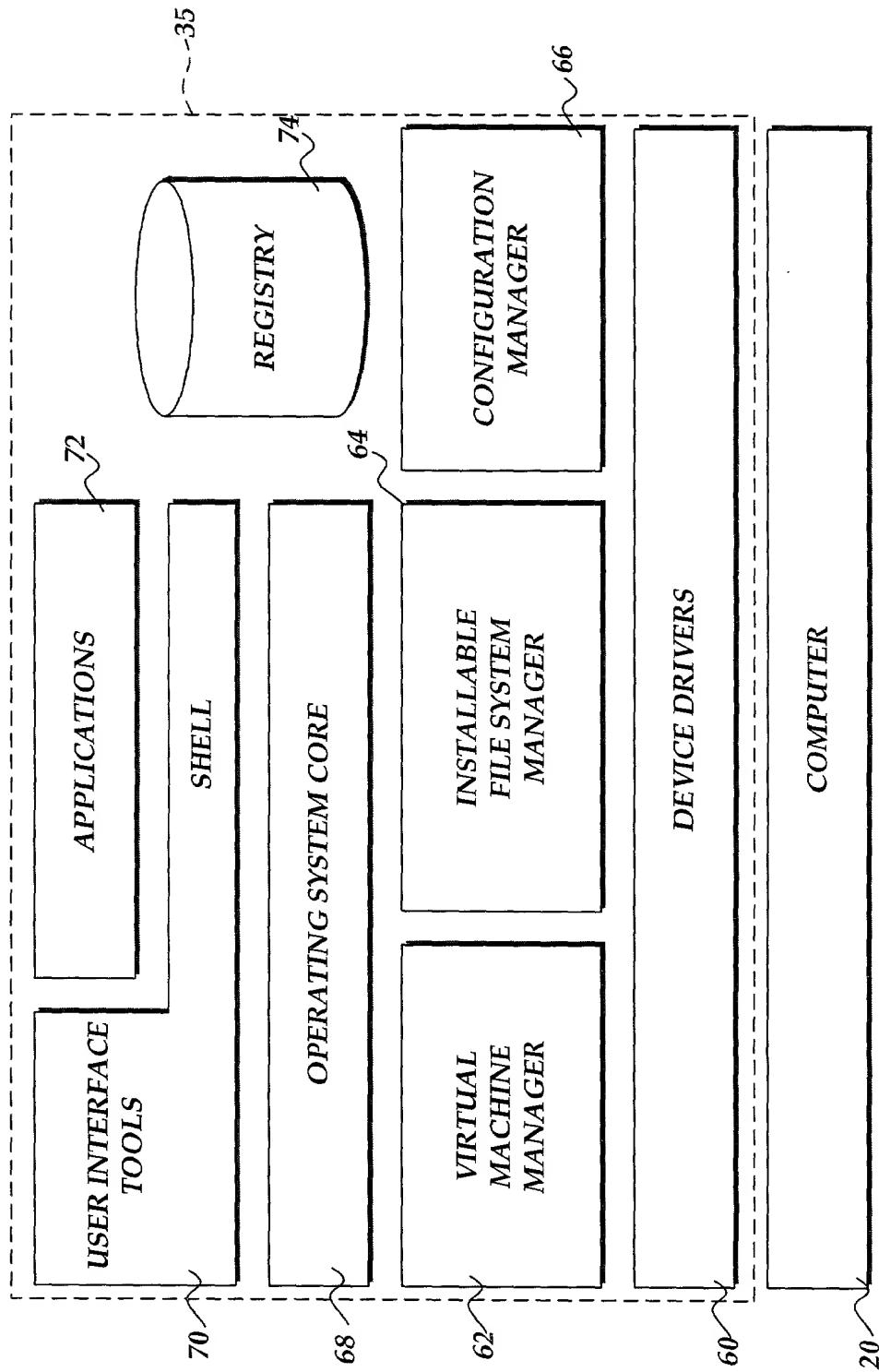
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SEND NL
(BLOCK 610, ROUTINE 600)

700

VALIDATE PARAMETERS ⟋702

DETERMINE PROCESSING FUNCTION
TO HANDLE WHEN "DE-QUEUED" ⟋704

ALLOCATE MEMORY FOR MESSAGE
ENTRY AND FILL MESSAGE ENTRY ⟋706

FILL IN THE EVENT HANDLE TO
SIGNAL WHEN PROCESSED ⟋708

FILL IN THE EVENT HANDLE FOR
OUTSIDE MESSAGES TO BE PROCESSED ⟋710

CALL ADDMESSAGEENTRY ROUTINE
(ROUTINE 800, FIG. 8) ⟋712

MARK RECEIVING CONTEXT
HAVING DATA (ATOMIC) ⟋713

714

DONE?   NO →   WAIT FOR RETURN
OBJECT AND
PROCESS OUTSIDE
MESSAGES   ⟋716

YES

COPY MESSAGE INFORMATION
BACK INTO THE MESSAGE ⟋718

FREE ANY ALLOCATED
MEMORY ⟋720

RETURN
(TO BLOCK 602, FIG. 6) ⟋722

Fig.7

Title: METHOD AND APPARATUS FOR PROVIDING AND
         INTEGRATING HIGH-PERFORMANCE MESSAGE
         QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
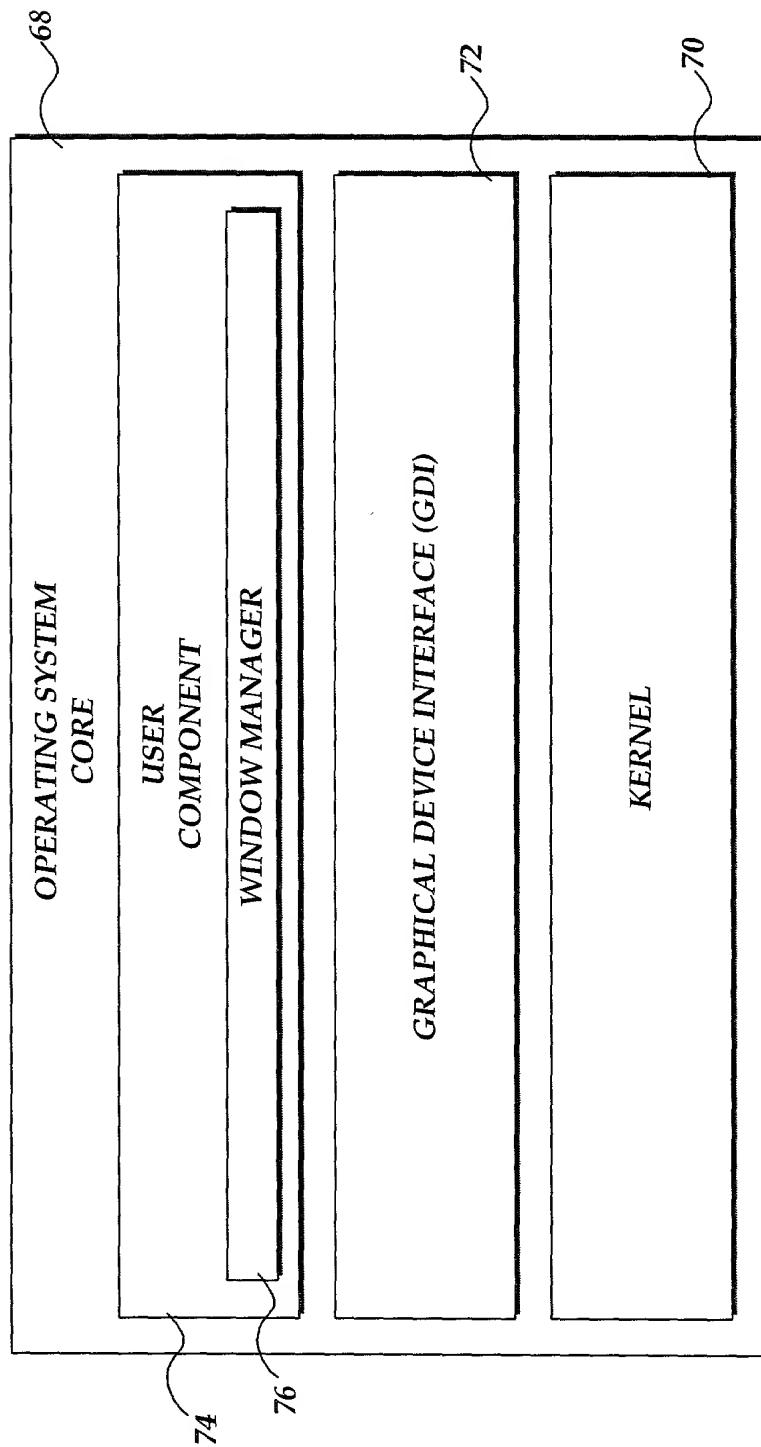Docket No.:   MSFT116666

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```
          ADDMESSAGEENTRY
      (BLOCK 712, ROUTINE 700)              ⟍ 800

                 │
                 ▼

          LOCK OBJECT              ⟍ 802

                 │
                 ▼

        ADD OBJECT INTO S-LIST
            (ATOMIC)              ⟍ 804

                 │
                 ▼

             RETURN
       (TO BLOCK 713, FIG. 7)     ⟍ 806
```

Fig.8

Title: METHOD AND APPARATUS FOR PROVIDING AND
          INTEGRATING HIGH-PERFORMANCE MESSAGE
          QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: ·   Jeffrey E. Stall
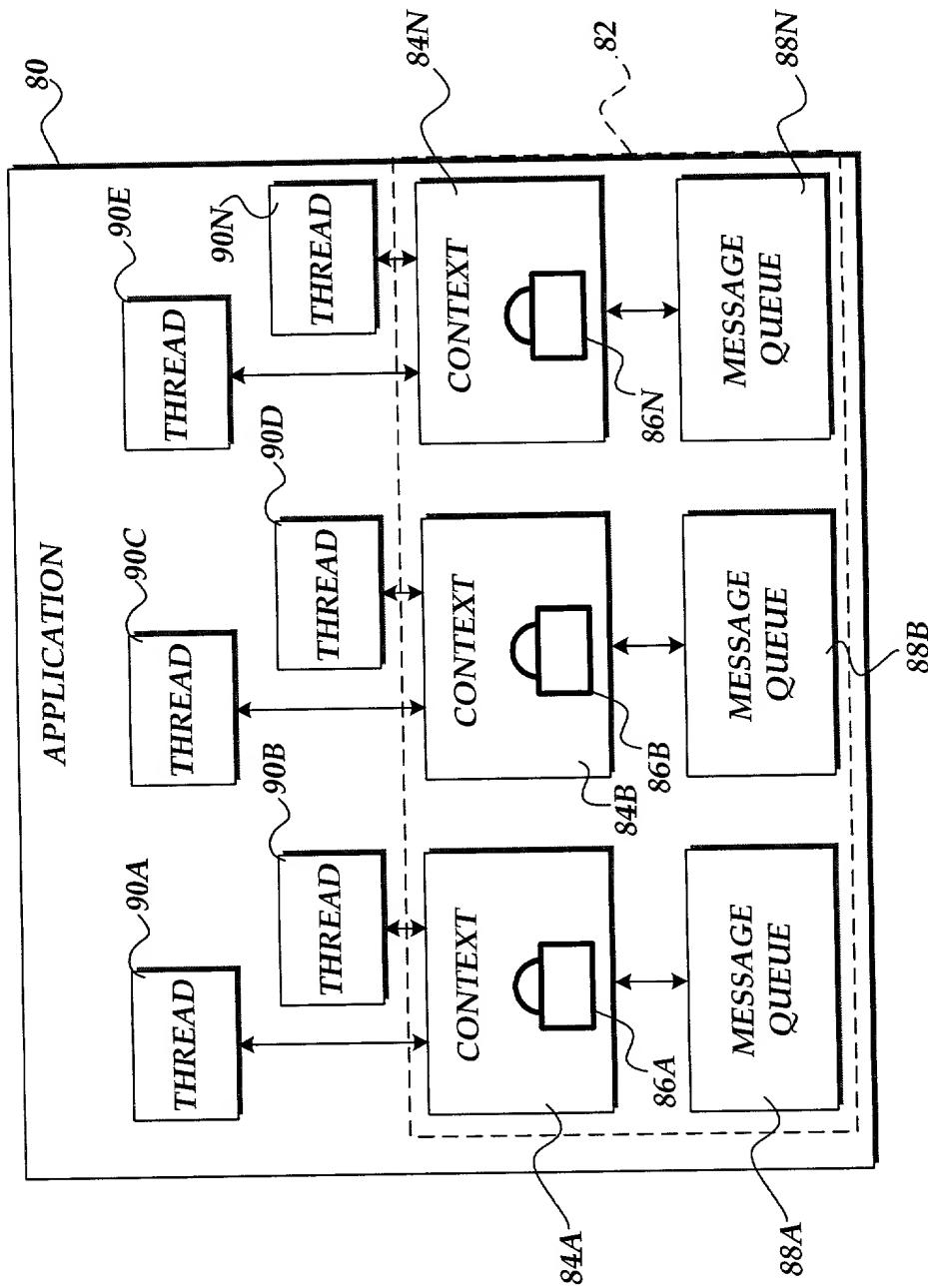Docket No.:   MSFT116666

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```
        ( POSTMESSAGE )                    ⤺  900

                │
                ▼
     ┌──────────────────────┐
     │ VALIDATE PARAMETERS   │──── 902
     └──────────────────────┘
                │
                ▼
     ┌──────────────────────┐
     │ DETERMINE PROCESSING  │
     │ FUNCTION TO HANDLE    │──── 904
     │ WHEN "DE-QUEUED"      │
     └──────────────────────┘
                │
                ▼
     ┌──────────────────────┐
     │ ALLOCATE MEMORY FOR   │
     │ MESSAGE ENTRY AND FILL│──── 906
     │ MESSAGE ENTRY         │
     └──────────────────────┘
                │
                ▼
     ┌──────────────────────┐
     │ CALL ADDMESSAGEENTRY  │
     │ ROUTINE               │──── 908
     │ (ROUTINE 800, FIG. 8) │
     └──────────────────────┘
                │
                ▼
     ┌──────────────────────┐
     │ MARK RECEIVING        │
     │ CONTEXT HAVING DATA   │──── 910
     │ (ATOMIC)              │
     └──────────────────────┘
                │
                ▼
          (    END    )──── 912
```

Fig.9

Title: METHOD AND APPARATUS FOR PROVIDING AND
         INTEGRATING HIGH-PERFORMANCE MESSAGE
         QUEUES IN A USER INTERFACE ENVIRONMENT
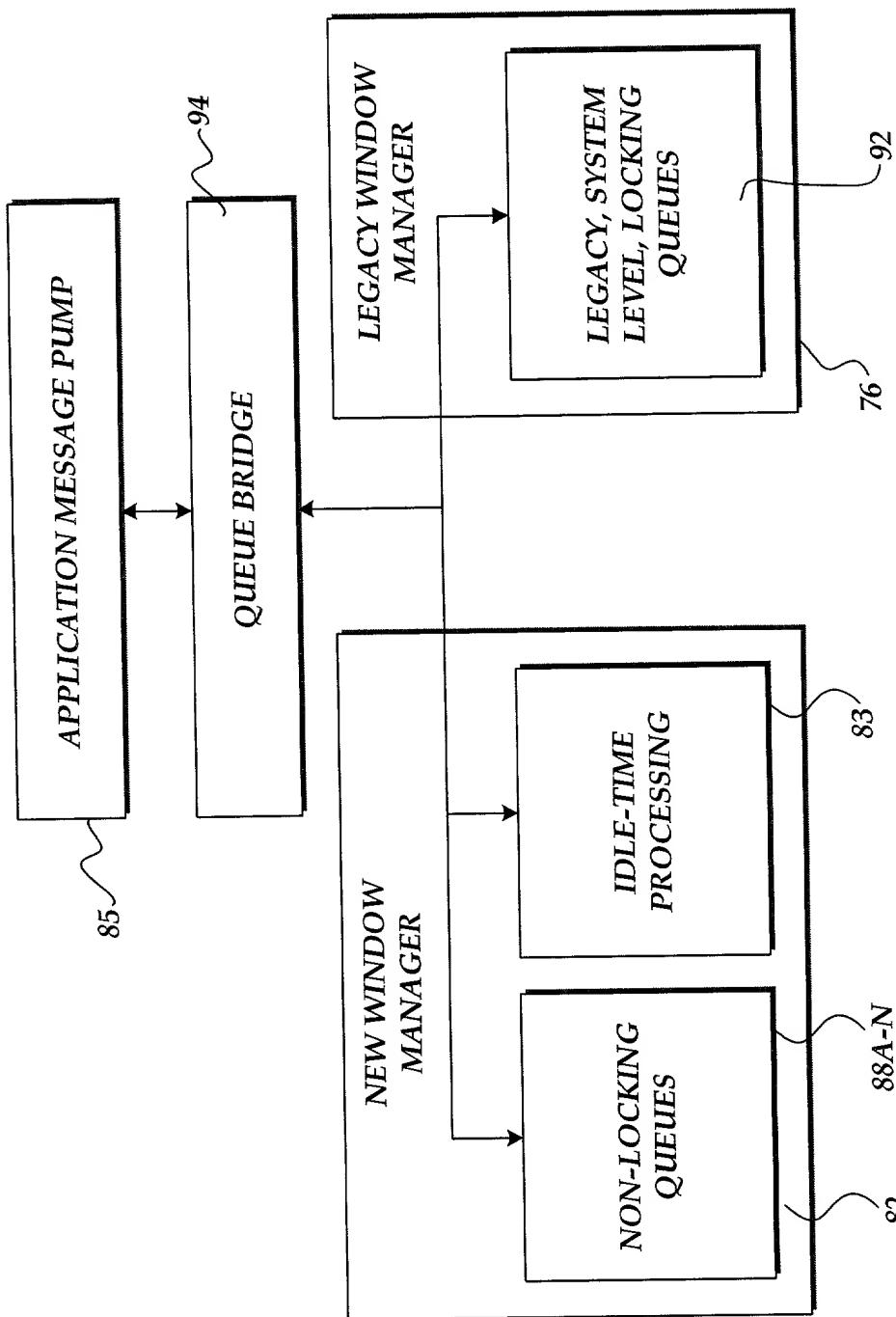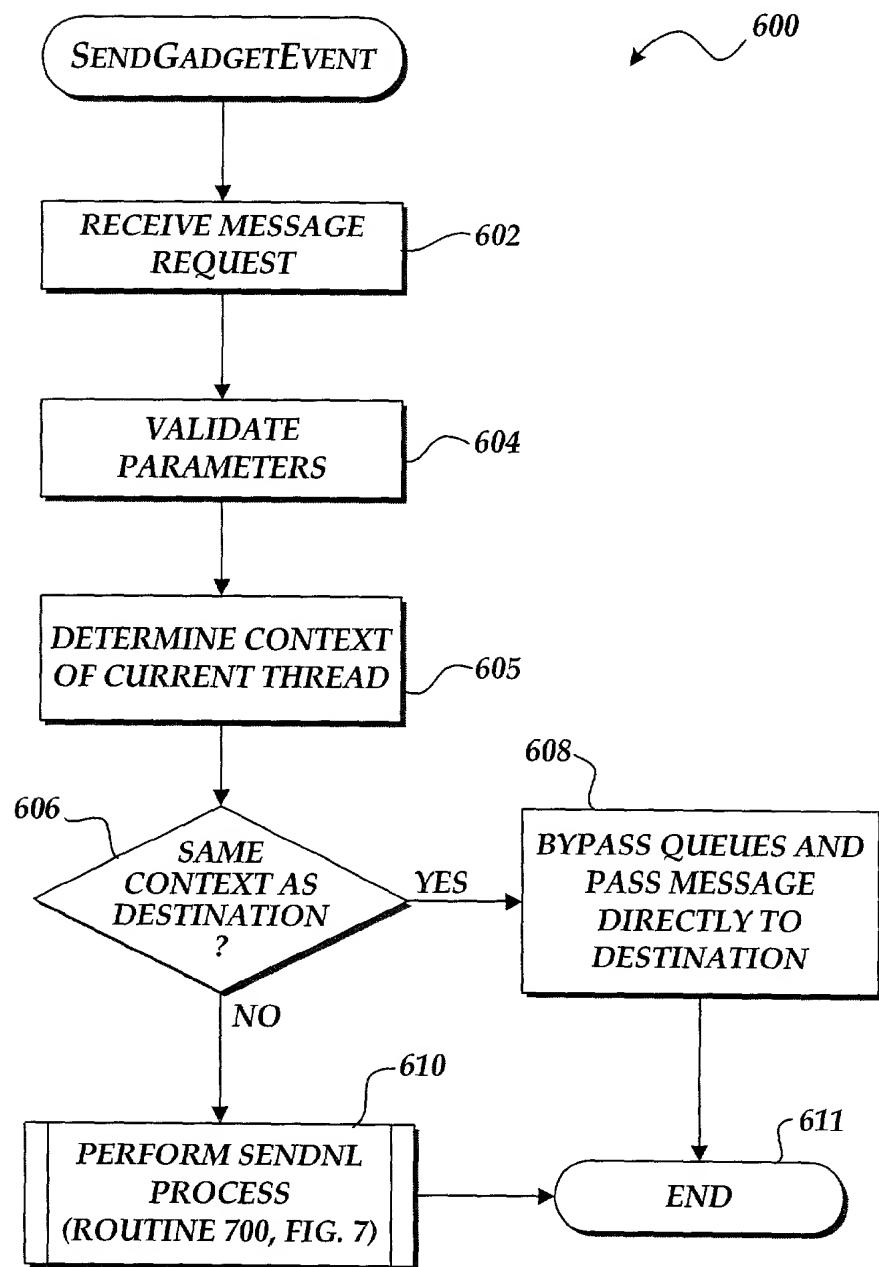Inventor: Jeffrey E. Stall
Docket No.:   MSFT116666

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```
                    ┌─────────────────────┐
                    │  PROCESS MESSAGE    │ ←──── 1000
                    │      QUEUE          │
                    └─────────────────────┘
                              │
        ┌─────────────────────┼─────────────────────┐
        │ 1002                ▼                      │
        │              ╱─────────────╲     YES       │
        │             ╱     ANY       ╲──────────────┼───┐
        │            ╱ OTHER THREAD    ╲             │   │
        │            ╲  PROCESSING?    ╱             │   │
        │             ╲               ╱              │   │
   ATOMIC─────┤         ╲─────────────╱               │   │
        │              │ NO                           │   │
        │              ▼                              │   │
        │   ┌──────────────────────┐                  │   │
        │   │ INDICATE THAT CURRENT│──── 1004         │   │
        │   │ THREAD IS PROCESSING │                  │   │
        │   │   MESSAGE QUEUE      │                  │   │
        │   └──────────────────────┘                  │   │
        └─────────────────┼───────────────────────────┘   │
                          ▼                                │
              ┌──────────────────────┐                     │
              │ CALL PROCESS ROUTINE FOR                    │
              │ THE SEND QUEUE (ATOMIC)│──── 1006           │
              │ (ROUTINE 1100, FIG. 11)│                    │
              └──────────────────────┘                     │
                          ▼                                │
              ┌──────────────────────┐                     │
              │ CALL PROCESS ROUTINE FOR                    │
              │ THE POST QUEUE (ATOMIC)│──── 1008           │
              │ (ROUTINE 1100, FIG. 11)│                    │
              └──────────────────────┘                     │
                          ▼                                │
              ┌──────────────────────┐                     │
              │ INDICATE THAT NO THREAD IS                  │
              │ PROCESSING MESSAGE QUEUE│──── 1010          │
              └──────────────────────┘                     │
                          ▼                                │
                          ◄────────────────────────────────┘
                          ▼
                 ┌─────────────────┐
                 │      END        │──── 1012
                 └─────────────────┘
```

Fig.10

Title: METHOD AND APPARATUS FOR PROVIDING AND
INTEGRATING HIGH-PERFORMANCE MESSAGE
QUEUES IN A USER INTERFACE ENVIRONMENT
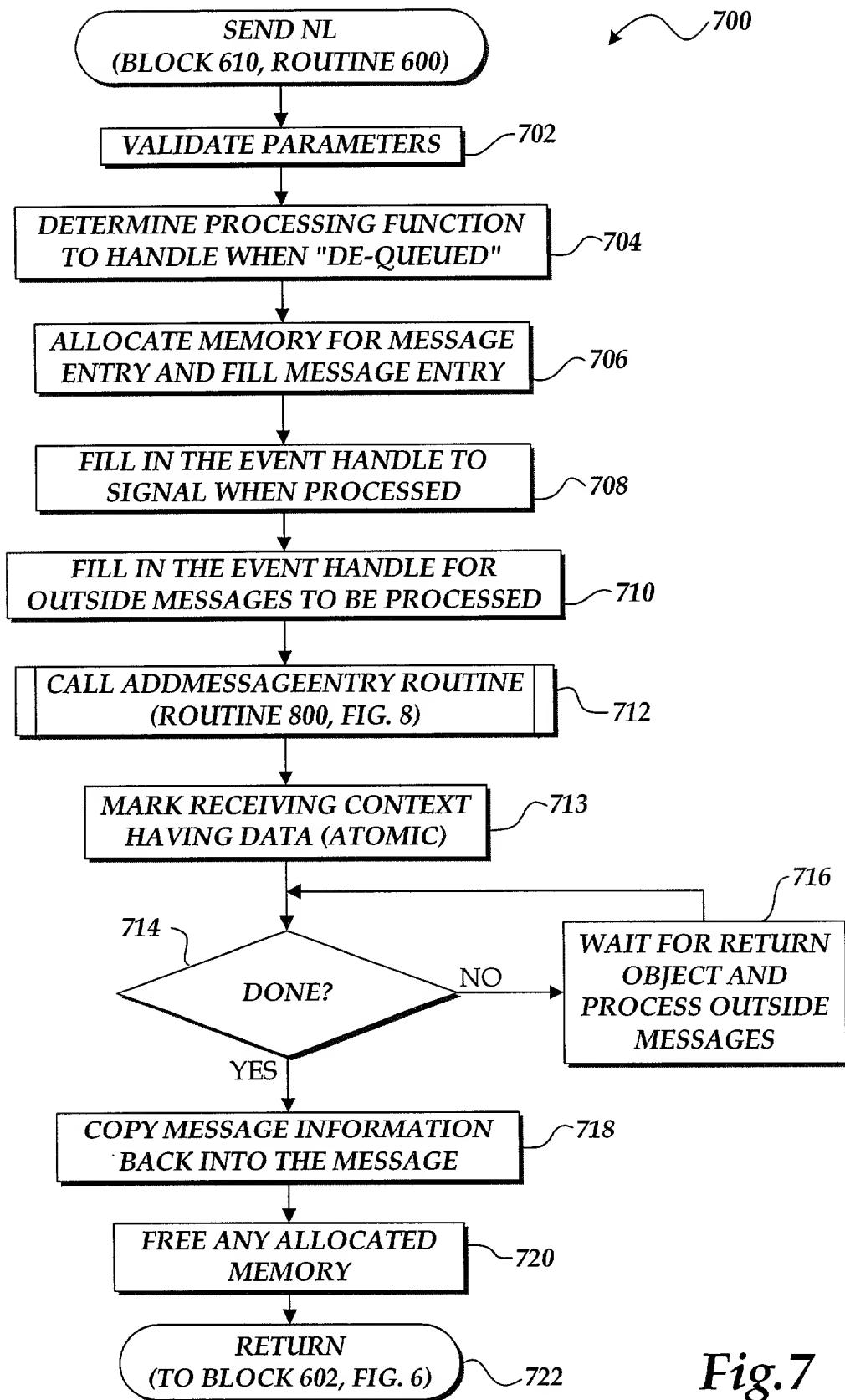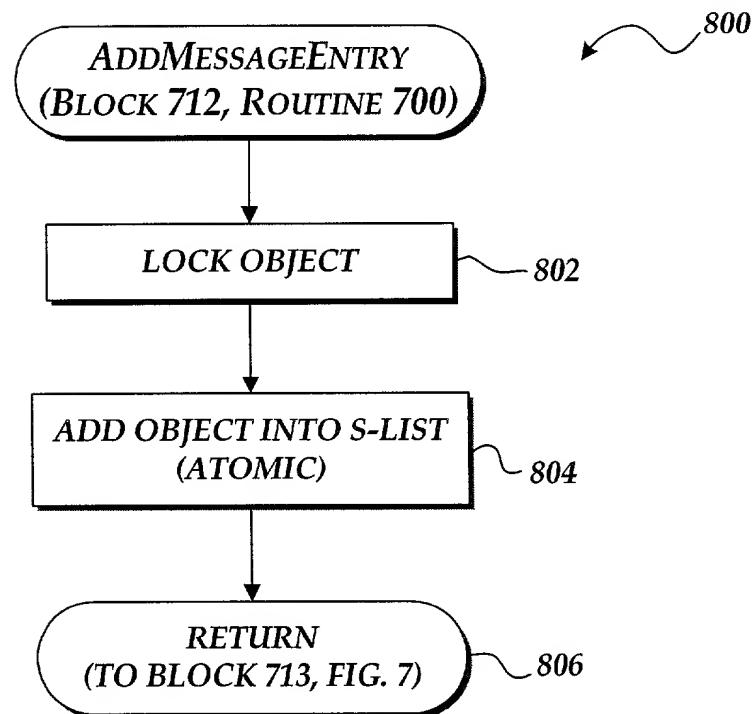Inventor: Jeffrey E. Stall
Docket No.: MSFT116666

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```
        ┌─────────────────────┐
        │      PROCESS         │
        │ (FROM BLOCKS 1006    │        1100
        │  AND 1008, FIG. 10)  │
        └─────────────────────┘
                  │
                  ▼
                              1102
          ╱─────────────────╲          YES
         ╱   LIST EMPTY?      ╲ ─────────────────┐
         ╲                    ╱                  │
          ╲─────────────────╱                    │
                  │ NO                            │
                  ▼                               │
        ┌─────────────────────┐                  │
        │ S-LIST EXTRACT THE   │    1104          │
        │   LIST (ATOMIC)      │                  │
        └─────────────────────┘                  │
                  │                               │
                  ▼                               │
        ┌─────────────────────┐                  │
        │  REVERSE THE LIST    │    1106          │
        └─────────────────────┘                  │
                  │                               │
                  ▼                               │
        ┌─────────────────────┐                  │
        │ CALL PROCESS LIST    │                  │
        │    ROUTINE           │    1108          │
        │ (ROUTINE 12, FIG. 12)│                  │
        └─────────────────────┘                  │
                  │               1110            │
                  ▼                               │
        ┌─────────────────────┐                  │
        │      RETURN          │◄─────────────────┘
        └─────────────────────┘
```

Fig.11

Title: METHOD AND APPARATUS FOR PROVIDING AND
          INTEGRATING HIGH-PERFORMANCE MESSAGE
          QUEUES IN A USER INTERFACE ENVIRONMENT
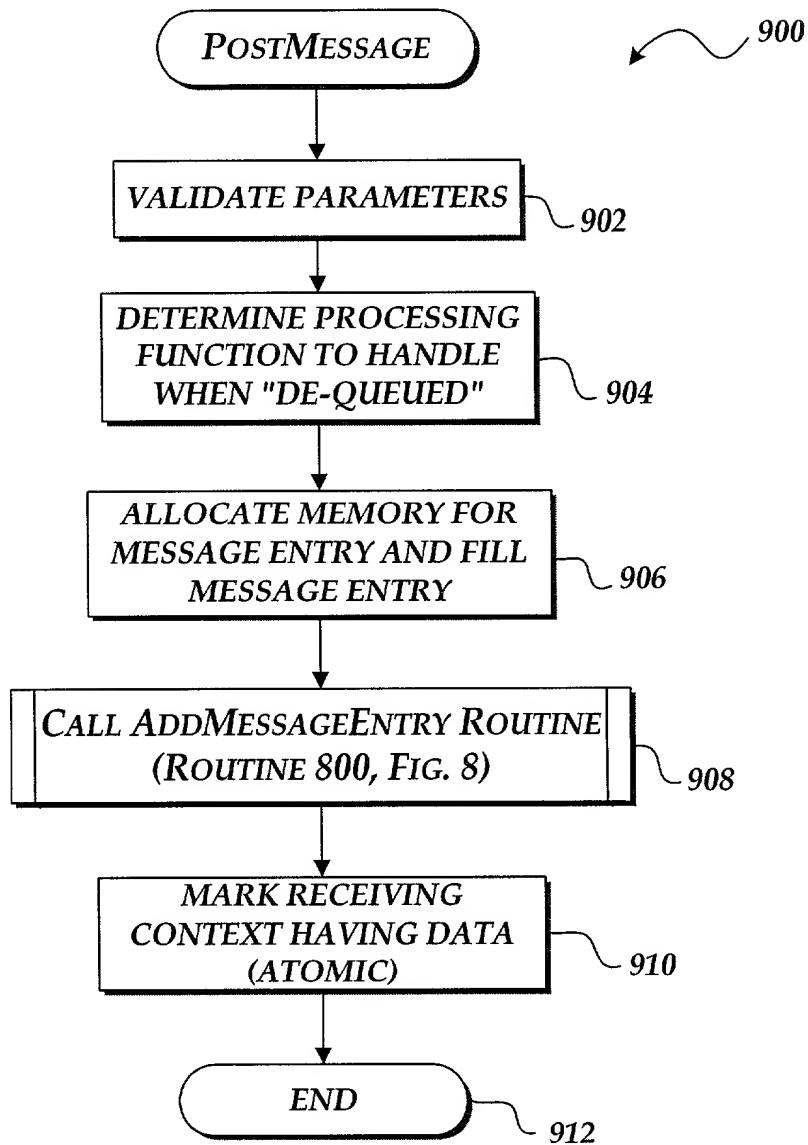Inventor: Jeffrey E. Stall
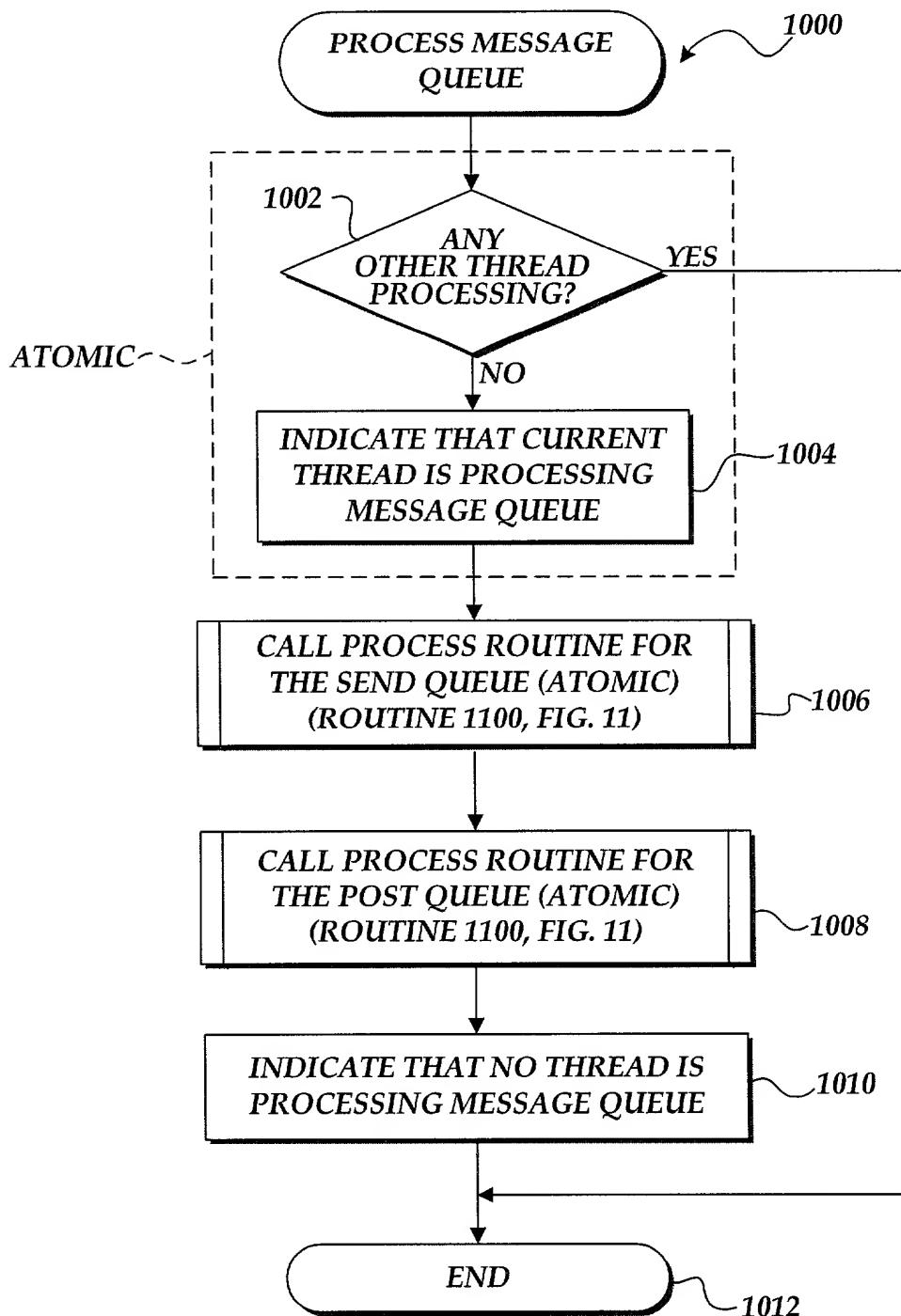Docket No.:   MSFT116666

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PROCESS LIST
(FROM BLOCK 1108,
FIG. 11)

1200

LIST EMPTY? — YES

1202

NO

EXTRACT HEAD
MESSAGEENTRY — 1204

PROCESS THE
MESSAGEENTRY — 1206

GRAB CONTEXT LOCK — 1208

UNLOCK THE OBJECT — 1210

RELEASE CONTEXT LOCK — 1212

S-LIST ADD TO RETURN
MEMORY TO SENDER
(ATOMIC) — 1214

1216

RETURN

Fig.12

Title: METHOD AND APPARATUS FOR PROVIDING AND
INTEGRATING HIGH-PERFORMANCE MESSAGE
QUEUES IN A USER INTERFACE ENVIRONMENT
Inventor: Jeffrey E. Stall
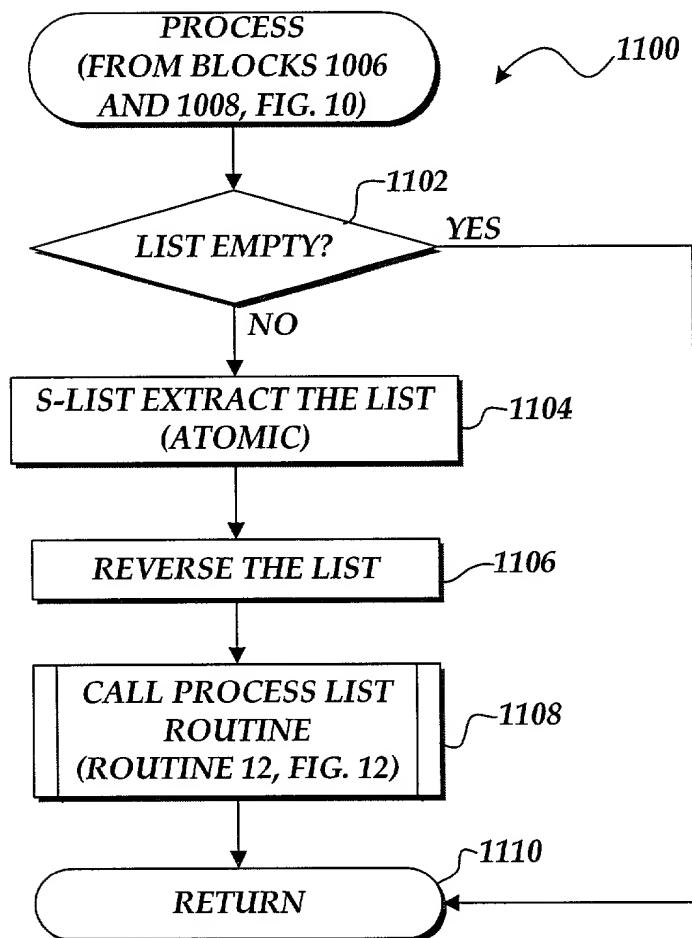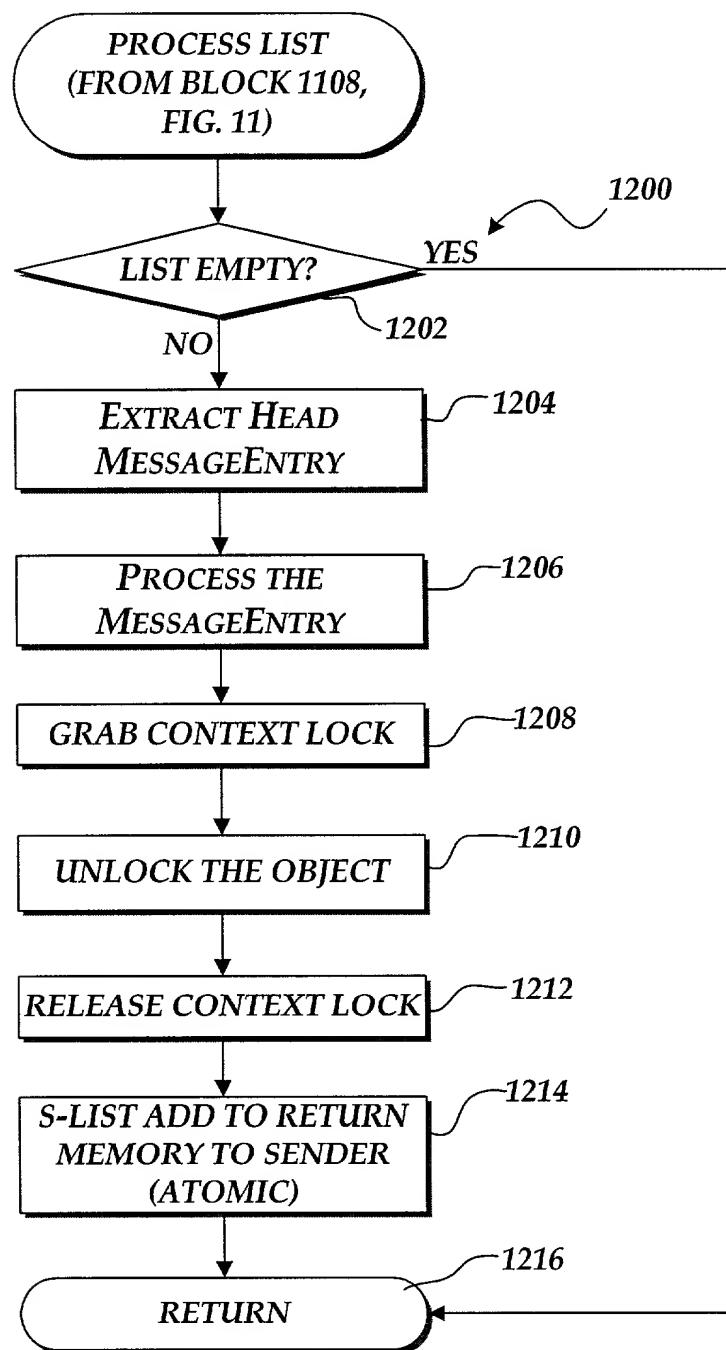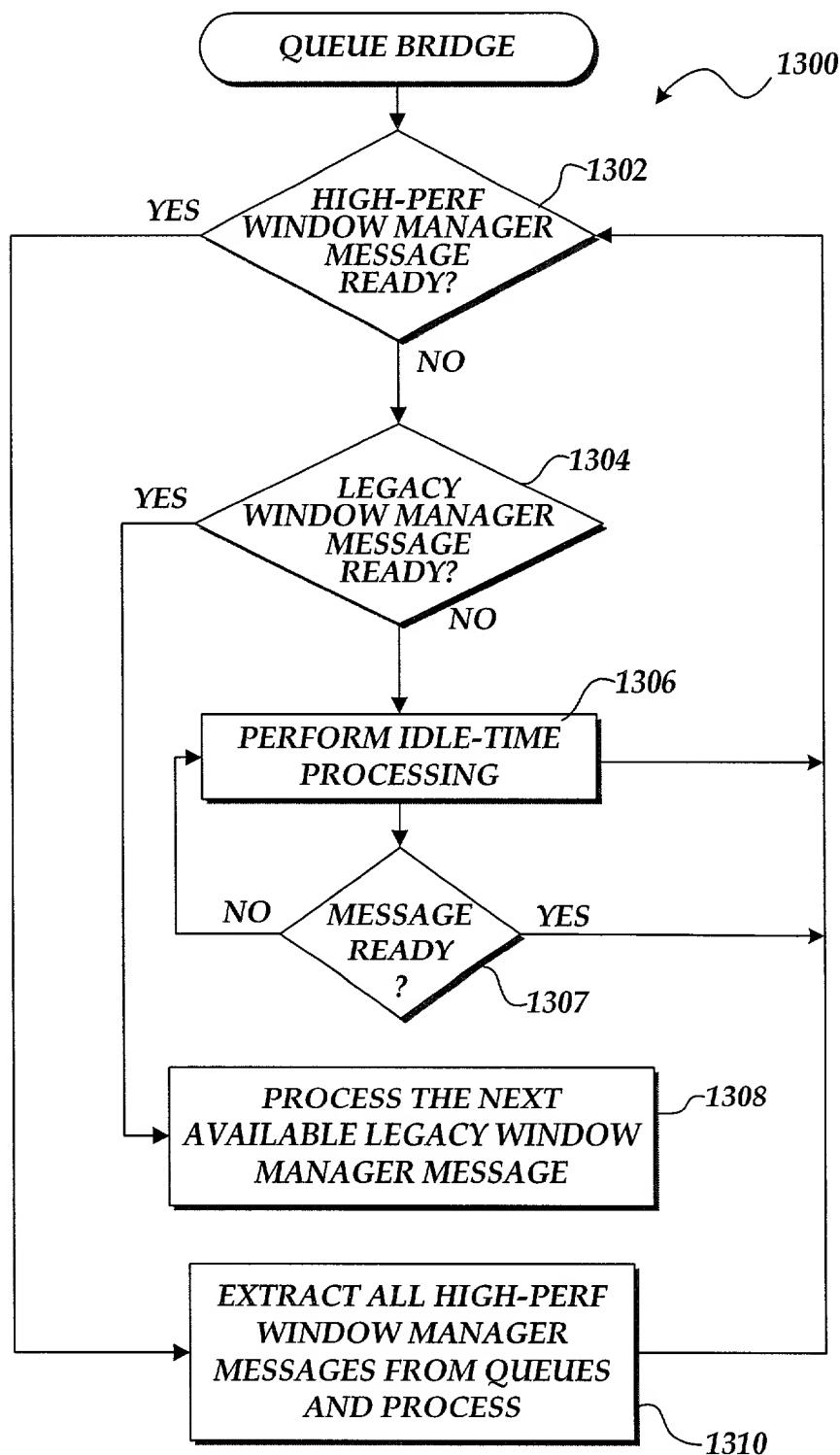Docket No.: MSFT116666

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```
                    ┌──────────────────────────┐
                    │      QUEUE BRIDGE         │
                    └──────────────────────────┘
                                 │                    ↙ 1300
                                 ▼
                          ╱─────────────╲   ⟋1302
              YES        ╱  HIGH-PERF    ╲
         ◄──────────────╱ WINDOW MANAGER  ╲
                        ╲    MESSAGE      ╱
                         ╲    READY?     ╱
                          ╲─────────────╱
                                 │ NO
                                 ▼
                          ╱─────────────╲  ⟋1304
              YES        ╱    LEGACY     ╲
         ◄──────────────╱ WINDOW MANAGER  ╲
                        ╲    MESSAGE      ╱
                         ╲    READY?     ╱
                          ╲─────────────╱
                                 │ NO
                                 ▼
              ┌────────────────────────────────┐  ⟋1306
              │      PERFORM IDLE-TIME          │────────►
              │        PROCESSING               │
              └────────────────────────────────┘
                                 │
                                 ▼
                       ╱─────────────╲
              NO       ╱   MESSAGE    ╲      YES
         ◄────────────╱    READY       ╲──────────►
                      ╲      ?         ╱
                       ╲─────────────╱  ⟍1307
                                 │
                                 ▼
              ┌────────────────────────────────┐
              │       PROCESS THE NEXT          │ ⟋1308
              │ AVAILABLE LEGACY WINDOW         │
              │     MANAGER MESSAGE             │
              └────────────────────────────────┘

              ┌────────────────────────────────┐
              │     EXTRACT ALL HIGH-PERF       │
              │     WINDOW MANAGER              │
              │  MESSAGES FROM QUEUES           │
              │       AND PROCESS               │
              └────────────────────────────────┘
                                      ⟍1310
```

Fig.13